

**American College of Radiology  
ACR Appropriateness Criteria®**

**Malignant or Aggressive Primary Musculoskeletal Tumor-Staging And Surveillance**

**Variant 1: Malignant or aggressive primary musculoskeletal tumor. Initial staging. Evaluation for pulmonary metastasis.**

Procedure	Appropriateness Category	SOE	Adults RRL	Peds RRL	Rating	Median	Final Tabulations								
							1	2	3	4	5	6	7	8	9
CT chest without IV contrast	Usually appropriate	Strong	☼☼☼ 1-10 mSv	☼☼☼☼ 3-10 mSv [ped]	9	9	0	0	0	0	0	1	1	2	13
		References		Study Quality											
		9 (26472138)		2											
		11 (16410133)		2											
		12 (21513852)		4											
FDG-PET/CT whole body	May be appropriate	Strong	☼☼☼☼ 10-30 mSv	☼☼☼☼ 3-10 mSv [ped]	5	5	0	0	0	2	10	4	0	0	0
		References		Study Quality											
		16 (22745027)		2											
		6 (30953476)		Good											
		13 (19352275)		3											
		15 (22134535)		3											
		14 (23251096)		3											
CT chest with IV contrast	Usually not appropriate	Expert Consensus	☼☼☼ 1-10 mSv	☼☼☼☼ 3-10 mSv [ped]	1	1	10	0	6	0	0	0	0	0	0
CT chest without and with IV contrast	Usually not appropriate	Expert Consensus	☼☼☼ 1-10 mSv	☼☼☼☼ 3-10 mSv [ped]	1	1	10	1	4	0	0	1	0	0	0

Radiography chest	Usually not appropriate	Expert Consensus	⊕ <0.1 mSv	⊕ <0.03 mSv [ped]	1	1	14	0	1	0	0	1	0	0	0
FDG-PET/MRI whole body	Usually not appropriate	Limited	⊕⊕⊕ 1-10 mSv	⊕⊕⊕⊕ 3-10 mSv [ped]	1	1	10	1	3	1	1	1	0	0	0
References			Study Quality												
17 (27951459)			3												

**Variant 2: Malignant or aggressive primary musculoskeletal tumor. Initial staging. Evaluation for extrapulmonary metastasis.**

Procedure	Appropriateness Category	SOE	Adults RRL	Peds RRL	Rating	Median	Final Tabulations								
							1	2	3	4	5	6	7	8	9
FDG-PET/CT whole body	Usually appropriate	Strong	⊕⊕⊕⊕ 10-30 mSv	⊕⊕⊕⊕ 3-10 mSv [ped]	8	8	0	0	0	0	2	0	4	4	7
References			Study Quality												
37 (18048826)			3												
34 (16951929)			2												
36 (21716019)			2												
33 (11418435)			2												
22 (25539251)			3												
32 (14693872)			2												
30 (31601386)			2												
35 (31016339)			2												
6 (30953476)			Good												
31 (29189489)			4												
15 (22134535)			3												
MRI whole body without IV contrast	May be appropriate (Disagreement)	Expert Opinion	○ 0 mSv	○ 0 mSv [ped]	5	5	1	0	1	1	10	0	0	2	1
References			Study Quality												
34 (16951929)			2												

33 (11418435)	2
32 (14693872)	2
29 (30915559)	4
42 (31447287)	4
35 (31016339)	2
44 (26831007)	3
40 (29558901)	4
41 (29275455)	4
43 (20369068)	4

Bone scan whole body with SPECT or SPECT/CT area of interest	May be appropriate	Limited	☹☹☹ 1-10 mSv	☹☹☹☹ 3-10 mSv [ped]	5	5	0	0	2	1	7	6	0	0	0
--	--------------------	---------	--------------	---------------------	---	---	---	---	---	---	---	---	---	---	---

References	Study Quality
30 (31601386)	2

Fluoride PET/CT whole body	May be appropriate (Disagreement)	Expert Opinion	☹☹☹☹ 10-30 mSv	☹☹☹☹ 3-10 mSv [ped]	5	5	3	0	4	2	4	3	0	0	0
----------------------------	-----------------------------------	----------------	----------------	---------------------	---	---	---	---	---	---	---	---	---	---	---

References	Study Quality
39 (28798033)	2

FDG-PET/MRI whole body	May be appropriate	Limited	☹☹☹ 1-10 mSv	☹☹☹☹ 3-10 mSv [ped]	5	5	0	0	1	3	11	0	1	0	0
------------------------	--------------------	---------	--------------	---------------------	---	---	---	---	---	---	----	---	---	---	---

References	Study Quality
38 (24309383)	3
17 (27951459)	3

Bone scan whole body	May be appropriate	Strong	☹☹☹ 1-10 mSv	☹☹☹☹ 3-10 mSv [ped]	4	4	0	0	2	7	5	1	0	0	1
----------------------	--------------------	--------	--------------	---------------------	---	---	---	---	---	---	---	---	---	---	---

References	Study Quality
22 (25539251)	3
28 (20224457)	2
23 (25533313)	2
29 (30915559)	4
24 (23995264)	3

25 (9779715)	3
26 (12750613)	3
27 (19542943)	4

MRI whole body without and with IV contrast	Usually not appropriate	Expert Consensus	0 0 mSv	0 0 mSv [ped]	2	2	8	1	5	2	0	0	0	0	0
CT area of interest with IV contrast	Usually not appropriate	Expert Consensus	Varies	Varies	1	1	11	0	4	1	0	0	0	0	0
CT area of interest without IV contrast	Usually not appropriate	Expert Consensus	Varies	Varies	1	1	11	0	5	0	0	0	0	0	0
CT area of interest without and with IV contrast	Usually not appropriate	Expert Consensus	Varies	Varies	1	1	11	0	5	0	0	0	0	0	0
US area of interest	Usually not appropriate	Expert Consensus	0 0 mSv	0 0 mSv [ped]	1	1	14	1	0	0	1	0	0	0	0
Radiography area of interest	Usually not appropriate	Expert Consensus	Varies	Varies	1	1	14	1	0	0	0	0	0	0	1

**Variant 3: Malignant or aggressive primary musculoskeletal tumor with no suspected or known recurrence. Surveillance for pulmonary metastasis.**

Procedure	Appropriateness Category	SOE	Adults RRL	Peds RRL	Rating	Median	Final Tabulations								
							1	2	3	4	5	6	7	8	9
CT chest without IV contrast	Usually appropriate	Strong	⊕⊕⊕ 1-10 mSv	⊕⊕⊕⊕ 3-10 mSv [ped]	9	9	0	0	0	1	0	0	1	2	13

References	Study Quality
56 (21537873)	3
55 (17438474)	3
9 (26472138)	2
45 (31377411)	4
54 (24249538)	2
12 (21513852)	4

			53 (29437071)		2													
FDG-PET/CT whole body	May be appropriate	Limited	⊕⊕⊕⊕ 10-30 mSv	⊕⊕⊕⊕ 3-10 mSv [ped]	5	5	0	0	0	1	13	1	1	0	0			
			References		Study Quality													
			16 (22745027)		2													
			15 (22134535)		3													
CT chest with IV contrast	Usually not appropriate	Expert Consensus	⊕⊕⊕ 1-10 mSv	⊕⊕⊕⊕ 3-10 mSv [ped]	1	1	11	0	2	2	0	1	0	0	0			
CT chest without and with IV contrast	Usually not appropriate	Expert Consensus	⊕⊕⊕ 1-10 mSv	⊕⊕⊕⊕ 3-10 mSv [ped]	1	1	12	1	2	1	0	0	0	0	0			
Radiography chest	Usually not appropriate	Limited	⊕ <0.1 mSv	⊕ <0.03 mSv [ped]	1	1	10	3	3	0	0	0	0	0	0			
			References		Study Quality													
			57 (10674442)		3													
FDG-PET/MRI whole body	Usually not appropriate	Expert Consensus	⊕⊕⊕ 1-10 mSv	⊕⊕⊕⊕ 3-10 mSv [ped]	1	1	10	0	4	2	0	1	0	0	0			

**Variant 4: Malignant or aggressive primary bone tumor. Surveillance for local recurrence.**

Procedure	Appropriateness Category	SOE	Adults RRL	Peds RRL	Rating	Median	Final Tabulations											
							1	2	3	4	5	6	7	8	9			
MRI area of interest without and with IV contrast	Usually appropriate	Limited	○ 0 mSv	○ 0 mSv [ped]	9	9	0	0	0	0	0	0	1	1	15			
			References		Study Quality													
			67 (23246334)		3													
			68 (9285993)		4													
Radiography area of interest	Usually appropriate	Expert Consensus	Varies	Varies	9	9	1	0	0	0	0	2	1	1	12			

MRI area of interest without IV contrast	Usually appropriate	Expert Consensus	0 0 mSv	0 0 mSv [ped]	7	7	1	0	1	0	2	3	6	3	1
CT area of interest with IV contrast	May be appropriate	Expert Consensus	Varies	Varies	5	5	0	0	1	1	10	3	0	1	0
FDG-PET/CT whole body	May be appropriate	Limited	☼☼☼☼ 10-30 mSv	☼☼☼☼ 3-10 mSv [ped]	5	5	0	0	0	0	9	2	4	1	0
		References		Study Quality											
		64 (23558689)		3											
		65 (29261626)		3											
		66 (25431093)		2											
Bone scan whole body with SPECT or SPECT/CT area of interest	Usually not appropriate	Expert Consensus	☼☼☼ 1-10 mSv	☼☼☼☼ 3-10 mSv [ped]	2	2	8	3	2	2	1	0	1	0	0
Fluoride PET/CT whole body	Usually not appropriate	Expert Consensus	☼☼☼☼ 10-30 mSv	☼☼☼☼ 3-10 mSv [ped]	2	2	8	2	3	1	1	1	1	0	0
CT area of interest without IV contrast	Usually not appropriate	Expert Consensus	Varies	Varies	1	1	9	0	2	2	3	0	0	0	0
CT area of interest without and with IV contrast	Usually not appropriate	Expert Consensus	Varies	Varies	1	1	9	1	2	2	1	1	0	0	0
Bone scan whole body	Usually not appropriate	Limited	☼☼☼ 1-10 mSv	☼☼☼☼ 3-10 mSv [ped]	1	1	10	2	4	0	0	0	0	0	0
		References		Study Quality											
		22 (25539251)		3											
		23 (25533313)		2											
US area of interest	Usually not appropriate	Expert Consensus	0 0 mSv	0 0 mSv [ped]	1	1	10	2	1	2	1	1	0	0	0
FDG-PET/MRI whole body	Usually not appropriate	Expert Consensus	☼☼☼ 1-10 mSv	☼☼☼☼ 3-10 mSv [ped]	1	1	11	3	2	0	0	0	0	0	0



US area of interest	May be appropriate (Disagreement)	Expert Opinion	0 0 mSv	0 0 mSv [ped]	5	5	2	0	1	3	7	3	0	0	0
		References		Study Quality											
		84 (25794664)		3											
FDG-PET/MRI whole body	May be appropriate	Moderate	☼☼☼ 1-10 mSv	☼☼☼☼ 3-10 mSv [ped]	5	5	1	0	1	5	7	1	1	0	0
		References		Study Quality											
		81 (28567495)		2											
CT area of interest without and with IV contrast	Usually not appropriate	Expert Consensus	Varies	Varies	2	2	8	3	2	2	1	0	0	0	0
CT area of interest without IV contrast	Usually not appropriate	Expert Consensus	Varies	Varies	1	1	11	1	1	2	1	0	0	0	0
Radiography area of interest	Usually not appropriate	Expert Consensus	Varies	Varies	1	1	10	1	0	3	1	1	0	0	0



## **Appendix Key**

A more complete discussion of the items presented below can be found by accessing the supporting documents at the designated hyperlinks.

**Appropriateness Category:** The panel's recommendation for a procedure based on the assessment of the risks and benefits of performing the procedure for the specified clinical scenario.

**SOE:** Strength of Evidence. The assessment of the amount and quality of evidence found in the peer reviewed medical literature for an appropriateness recommendation.

- **References:** The citation number and PMID for the reference(s) associated with the recommendation.
- **Study Quality:** The assessment of the quality of an individual reference based on the number of study quality elements described in the reference.

**RRL:** Relative Radiation Level. A population based assessment of the amount of radiation a typical patient may be exposed to during the specified procedure.

**Rating:** The final rating (1-9 scale) for the procedure as determined by the panel during rating rounds.

**Median:** The median rating (1-9 scale) for the procedure as determined by the panel during rating rounds.

**Final tabulations:** A histogram showing the number of panel members who rated the procedure as noted in the column heading (ie, 1, 2, 3, etc.).

Additional supporting documents about the AC methodology and processes can be found at [www.acr.org/ac](http://www.acr.org/ac).